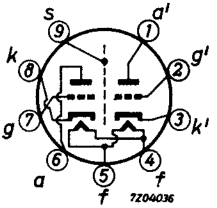
S.Q. TUBE

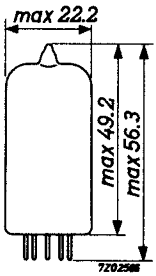
Special quality double triode designed for
- Cascode circuits
- H.F. or I.F. amplifiers
- Mixer or phase inverter stages
- Multivibrator and cathode follower in computers

QUICK REFERENCE DATA			
Life	10 000 hours		
Low interface resistance			
Mechanical quality	Shock and vibration resistant		
Base	Noval. Gold plated pins		
Heating	Indirect A.C. or D.C.; parallel supply		
Heater voltage	V_f	6.3	V
Heater current	I_f	300	mA
Anode current	I_a	15	mA
Mutual conductance	S	12.5	mA/V
Equivalent noise resistance	R_{eq}	300	Ω
Noise factor (f = 200 MHz)	F	4.6	dB

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: Noval





CHARACTERISTICS

Column I — Nominal value or setting of the tube
II — Range values for equipment design: Initial spread
III — Range values for equipment design: End of life

		I	II	III	
Heater voltage	V_f	6.3			V
Heater current	I_f	300	285 - 315		mA
Anode supply voltage	V_{ba}	100			V
Grid supply voltage	$+V_{bg}$	9			V
Cathode resistor	R_k	680			Ω
Anode current	I_a	15	14.2 - 15.8	min. 13.5	mA
Mutual conductance	S	12.5	10.5 - 15	min. 9	mA/V
Amplification factor	μ	33			
Equivalent noise resistance	R_{eq}	300			Ω
Frequency = 45 MHz					
Noise figure	F	4.6			dB
Frequency = 200 MHz					
In cascode circuit adapted to minimum noise					
Input resistance	r_g	3			kΩ
Frequency = 100 MHz					
Start of grid current	V_g	0.75			V_{RMS}
Negative grid current	$-I_g$		max. 0.1	max. 1	μA
Anode voltage	V_a	90			V
Anode current	I_a	15			mA
Anode supply voltage	V_{ba}	90			V
Cathode resistor	R_k	120			Ω
Anode current	I_a	12			mA
Mutual conductance	S	11.5			mA/V

CHARACTERISTICS (continued)

		I	II	III	
Cut-off voltage	$-V_g$	6.5	5 - 8.5		V
Anode voltage	V_a	150			V
Anode current	I_a	0.1			mA
Difference in grid voltage of two sections	$\lvert V_g - V_g' \rvert$		max. 2	max. 2	V
Anode voltage	$V_a = V_a'$	150			V
Anode current	$I_a = I_a'$	0.1			mA
Anode supply voltage	V_{ba}	150			V
Negative grid voltage	$-V_g$	15			V
Anode current	I_a		max. 5		µA
In circuit fig.1 "pag.7"					
Anode supply voltage	V_{ba}	150			V
Anode current (not permitted continuously)	I_a	33	28 - 38		mA
Anode supply voltage	V_{ba}	60			V
Anode current	I_a		max. 9		mA
Leakage current between cathode and heater	I_{kf}		max. 6	max.12	µA
Voltage between cathode and heater = 90 V, cath.neg. Voltage between cathode and heater = 120 V, cath.pos.					
Insulation resistance between two electrodes	R_{ins}		min.100	min. 20	MΩ
Voltage between electrodes = 200 V					
Hum voltage	V_g		max.50		μV_{RMS}
Centre heater transformer earthed					

Grid resistor R_g = 0.5 MΩ

CAPACITANCES Both sections if applicable

		I	II	
Anode to cathode, heater and screen	$C_{a/kfs}$	1.75	1.55 - 1.95	pF
	$C_{a'/k'fs}$	1.65	1.45 - 1.85	pF
Anode to cathode and heater	$C_{a/kf}$	0.5	0.4 - 0.6	pF
	$C_{a'/k'f}$	0.4	0.3 - 0.5	pF
Grid to cathode, heater and screen	$C_{g/kfs}$	3.3	2.7 - 3.9	pF
Grid to cathode and heater	$C_{g/kf}$	3.3	2.7 - 3.9	pF
Anode to grid	C_{ag}	1.4	1.2 - 1.6	pF
Anode to cathode	C_{ak}	0.18	0.14 - 0.22	pF
Cathode to heater	C_{kf}	2.6		pF
	$C_{k'f}$	2.7		pF
Anode to screen	C_{as}	1.3	1.1 - 1.5	pF
Anode to grid, heater and screen	$C_{a/gfs}$	3.0	2.7 - 3.3	pF
	$C_{a'/g'fs}$	2.9	2.6 - 3.2	pF
Cathode to grid, heater and screen	$C_{k/gfs}$	6.0	5.1 - 6.9	pF
Anode to anode other section	$C_{aa'}$		max. 0.045	pF
Grid to grid other section	$C_{gg'}$		max. 0.005	pF
Anode to grid other section	$C_{ag'}, C_{a'g}$		max. 0.005	pF
Grid to cathode other section	$C_{gk'}, C_{g'k}$		max. 0.005	pF

SHOCK AND VIBRATION RESISTANCE

The following test conditions are applied to assess the mechanical quality of the tube. These conditions are not intended to be used as normal operating conditions.

Shock

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

Vibration

The tube is subjected during 32 hours in each of 3 positions to a vibration frequency of 50 Hz with an acceleration of 2.5 g.

LIFE

Production samples are tested to be within the end of life values (column III) during 10 000 hours under the following conditions:

Anode supply voltage	V_{ba}	100	V
Grid supply voltage	$+V_{bg}$	9	V
Cathode resistor	R_k	680	Ω
Grid resistor	R_g	47	kΩ
Voltage between cathode and heater (cath.neg.)	V_{kf}	60	V
Anode current	I_a	15	mA

LIMITING VALUES Design centre rating system

Anode voltage	V_{a_o}	max.	550	V
Anode voltage (Zero cathode current)	V_a	max.	400	V
Anode voltage	V_a	max.	220	V
Anode voltage (Max. anode dissipation 0.8 W)	V_a	max.	250	V
Anode dissipation	W_a	max.	1.5	W
Anode dissipation (Max. anode dissipation of section 1 plus section 2 = 2 W)	W_a	max.	1.8	W
Grid dissipation	W_g	max.	30	mW
Grid voltage	$-V_g$	max.	100	V
Grid peak voltage Max. pulse duration 200 μsec Max. duty factor 0.1	$-V_{g_p}$	max.	200	V
Cathode current	I_k	max.	20	mA
Cathode peak current Max. pulse duration 200 μsec Max. duty factor 0.1	I_{k_p}	max.	100	mA

LIMITING VALUES (continued)

Voltage between cathode and heater				
Cathode positive	V_{kf}	max.	150	V
Cathode negative	V_{kf}	max.	100	V
Bulb temperature (Absolute max.)	t_{bulb}	max.	170	°C
Grid resistor (Anode current < 5 mA)	R_g	max.	1	MΩ

Heater voltage: The average heater voltage should be 6.3 V.
Variations of the heater voltage exceeding the range of 6.0 V to 6.6 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.

OPERATING CHARACTERISTICS

Output tube class A

Anode voltage	V_a		220		V
Load resistance	$R_{a\sim}$		20		kΩ
Grid voltage	$-V_g$		6.5		V
Input voltage	V_i	0	1.5	4.5	V_{RMS}
Anode current	I_a	6.5		9.2	mA
Output power	W_o		0.05	0.5	W
Total distortion	d_{tot}			7	%

Output tube class B (two tubes)

Continuous single tone input signal

Anode voltage	V_a		200		V
Load resistance	$R_{aa\sim}$		22		kΩ
Grid voltage	$-V_g$		6		V
Input voltage	V_i	0	0.9	4.0	V_{RMS}
Anode current	I_a	2x5		2x9	mA
Output power	W_o		0.05	1.2	W
Total distortion	d_{tot}			3	%

OPERATING CHARACTERISTICS (continued)

Output tube class B (two tubes)

Speech and music inputsignal

Anode voltage	V_a		200		V
Load resistance	$R_{a-a\sim}$		10		kΩ
Grid voltage	$-V_{g_1}$		6		V
Input voltage	V_i	0	0.9	4.0	V_{RMS}
Anode current	I_a	2x5		2x13.5	mA
Output power	W_o		0.05	1.5	W
Total distortion	d_{tot}			4	%

Mixer

Anode supply voltage	V_{ba}	60	90	150	V
Anode resistor	R_a	0	1	3.9	kΩ
Grid resistor	R_g	1	1	1	MΩ
Oscillator voltage	V_{osc}	2	2.5	3	V_{RMS}
Anode current	I_a	4.7	7.7	11	mA
Conversion conductance	S_c	2.9	3.5	4.1	mA/V
Internal resistance	R_i	8.3	7	6.1	kΩ

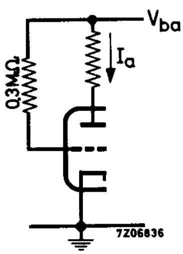
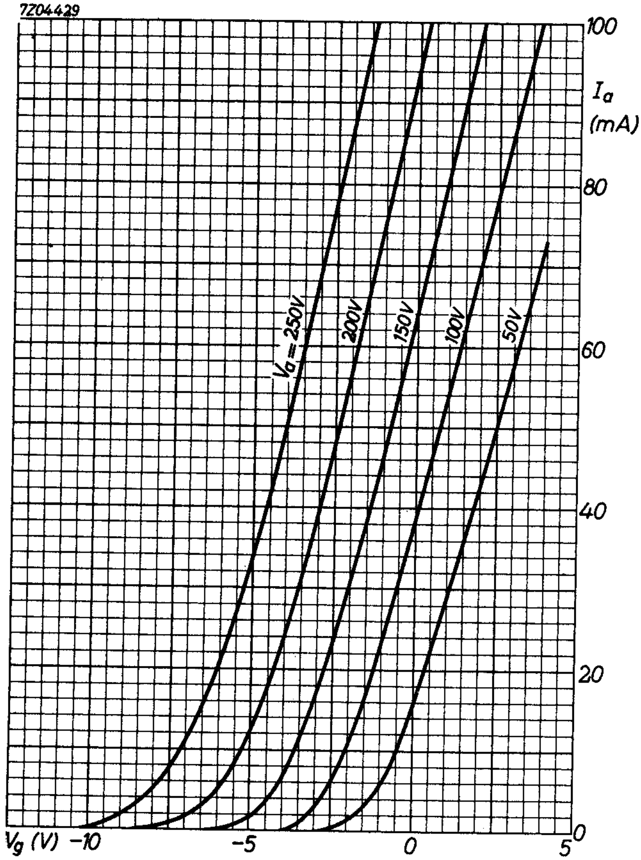
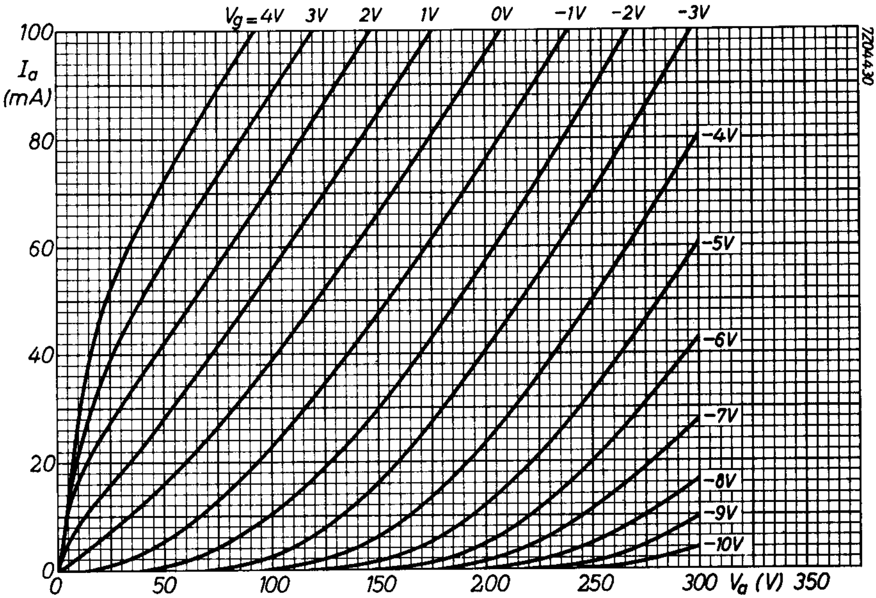
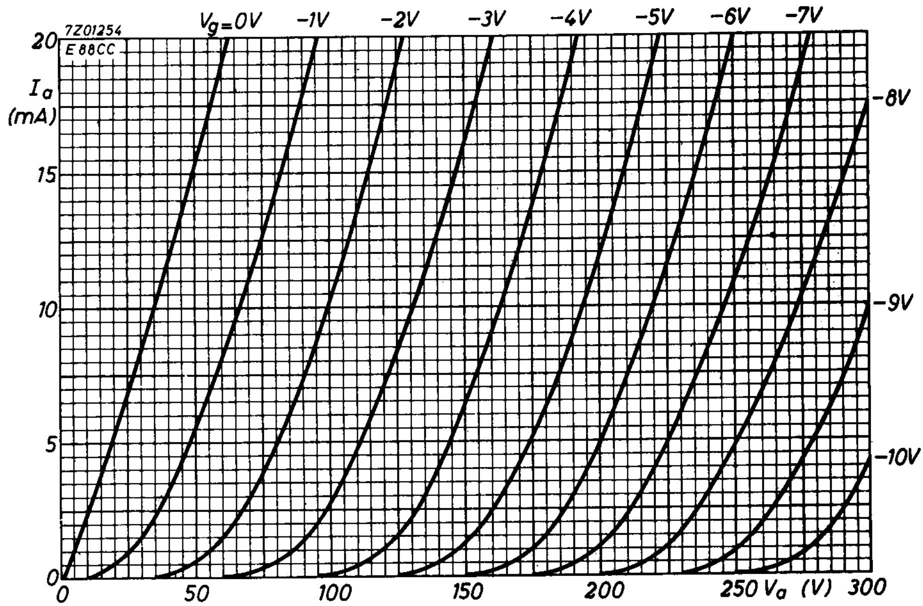


Fig.1

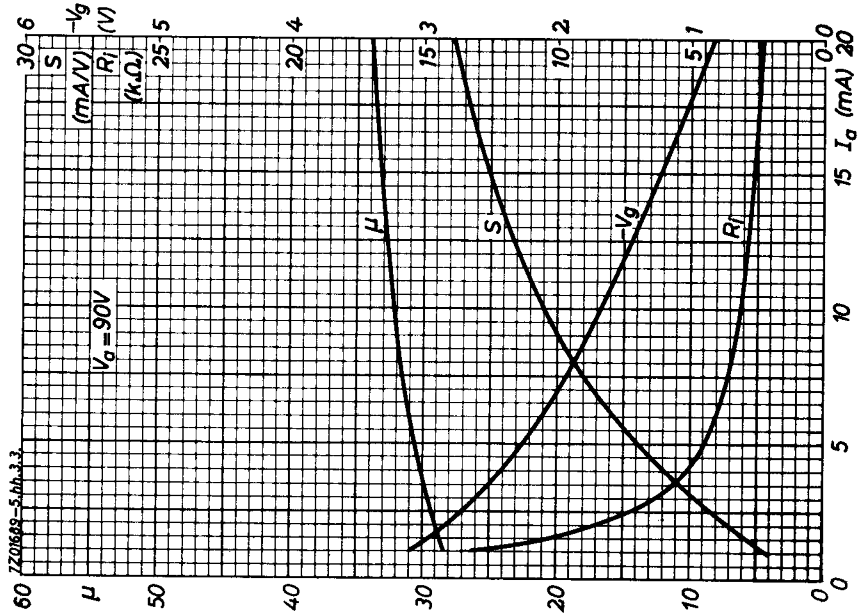

7Z04429
100
I_a
(mA)
80
60
40
20
0
V_a = 250V
200V
150V
100V
50V
V_g (V) −10
−5
0
5

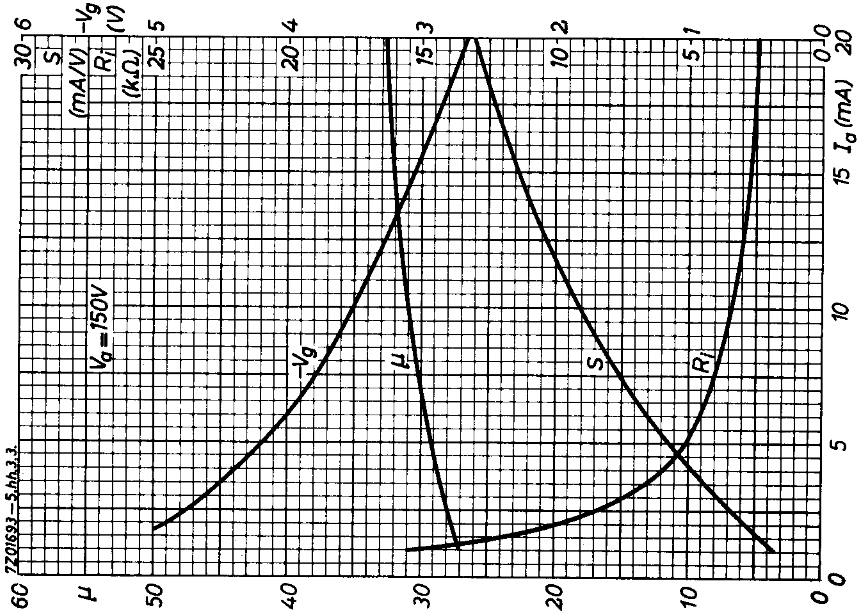


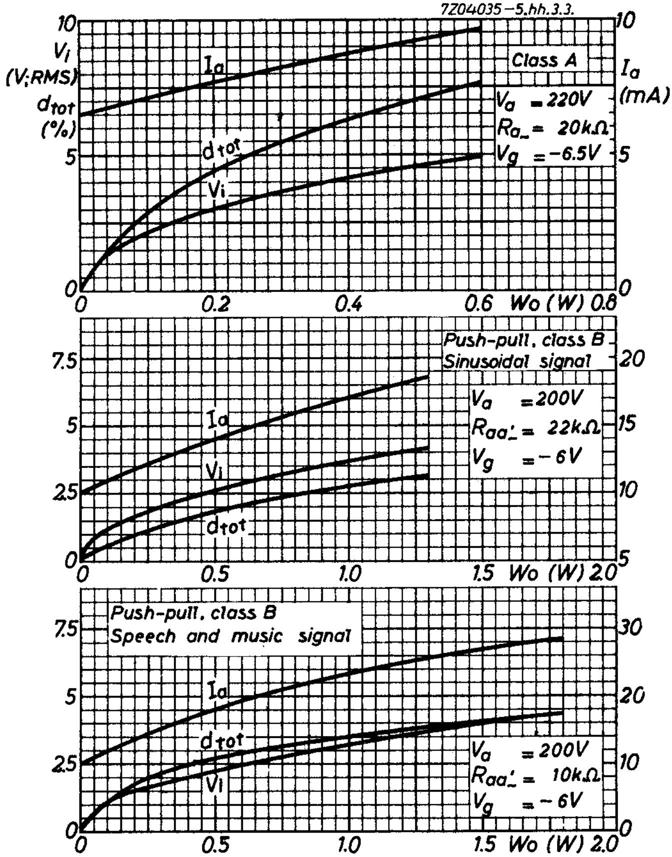
Vg = 4V
3V
2V
1V
0V
−1V
−2V
-3V
−4V
−5V
−6V
−7V
−8V
−9V
−10V
100
Ia
(mA)
80
60
40
20
0
0
50
100
150
200
250
300 Va (V) 350
7Z04430

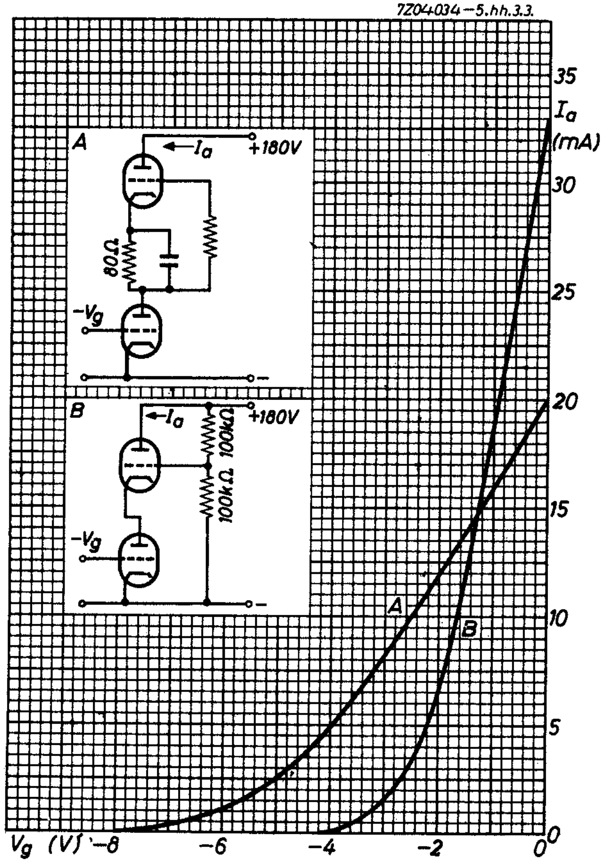


7Z01254
E 88CC
Vg = 0V
−1V
−2V
−3V
−4V
−5V
−6V
−7V
−8V
−9V
−10V
20
Ia
(mA)
15
10
5
0
0
50
100
150
200
250 Va (V) 300


$V_a = 90V$
7Z01689-5.hh.3.3.
S (mA/V)
R_i (kΩ)
$-V_g$ (V)
μ
I_a (mA)
μ
S
$-V_g$
R_i


$V_a = 150V$
7Z01693-5.hh.3.3.
S (mA/V)
R_i (kΩ)
$-V_g$ (V)
μ
I_a (mA)
$-V_g$
μ
S
R_i


7Z04035-5.hh.3.3.
10
V_i
(V;RMS)
d_{tot}
(%)
5
0
I_a
d_{tot}
V_i
Class A
V_a = 220V
$R_{a\sim}$ = 20kΩ
V_g = -6.5V
I_a
(mA)
0
0.2
0.4
0.6 Wo (W) 0.8
7.5
2.5
Push-pull, class B
Sinusoidal signal
V_a = 200V
$R_{aa\sim}$ = 22kΩ
V_g = -6V
20
15
10
0.5
1.0
1.5 Wo (W) 2.0
Push-pull, class B
Speech and music signal
V_a = 200V
$R_{aa\sim}$ = 10kΩ
V_g = -6V
30


7Z04034-5.hh.3.3.
A
I_a
+180V
80Ω
$-V_g$
B
100kΩ
100kΩ
35
30
25
20
15
10
5
0
I_a (mA)
V_g (V)
-8
-6
-4
-2
0

PHILIPS

Data handbook

Electronic components and materials

E88CC

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